Progress on an AERONET aerosol Opto-Physical Typology: defining the variable space and determination of a reference basis to produce a global aerosol climatology

Marco Giordano[a,b,*], Eric Wilcox[b], and Patrick Hamill[c,d]

[a]*Department of Physics, University of Nevada Reno, Leifsen Physics, Reno, NV 89512, USA*
[b]*Desert Research Institute, 2215 Raggio Parkway, Reno, NV 89512, USA*
[c]*Department of Physics, San Jose State University, San Jose, CA 95192, USA*
[d]*NASA Ames Research Center, Moffet Field, CA 94035, USA*

**Presenting author (marco@dri.edu)*

We present an aerosol classification based upon AERONET level 2.0 almucantar retrieval products from the period 1993 to 2012. We opto-physically identified five major types of Bulk Columnar Aerosol (BCA) – based solely upon intensive optical properties of spectral *Single Scattering Albedo* (SSA), spectral *Indices of Refraction* (real – RRI and imaginary – IRI), and two *Angstrom Exponents* (extinction – EAE and absorption – AAE). These BCA we classified as *Maritime Aerosol*, *Dust Aerosol*, *Urban Industrial Aerosol*, *Biomass Burning Aerosol*, and *Mixed Aerosol*. The classification of a particular aerosol observation as one of these aerosol types is determined by its five-dimensional Mahalanobis distance to each reference cluster (itself a 5-D *hyperellipsoid*). Studies with higher dimensional spaces by including other AERONET retrieved quantities, reduced the size of the global database – as not all properties were retrieved at as many sites throughout the record history. To retain a greater number of AERONET sites in the study, we kept the variable space to 5-D. We have calculated the fractional aerosol type distribution at 190 AERONET sites, as well as the monthly variation in aerosol type at those locations. The results are presented on a global map. Our aerosol typing is based on recognizing that different geographic regions exhibit characteristic aerosol types. To generate reference clusters we only keep data points that lie within a Mahalanobis distance of 2 from the data centroid. Our aerosol characterization is based on the AERONET retrieved quantities, therefore it does not include low optical depth values. The analysis is based on "point sources" (the AERONET sites) rather than globally distributed values. The classifications obtained will be useful in interpreting aerosol retrievals from satellite borne instruments and as input for regional climate models. It is evidenced that each of these five aerosol types can be further discriminated into specific *aerosol sub-types* by this same classification scheme. The application of further optical discrimination into *sub-types* of the *Biomass Burning* aerosol may provide insight into complicated *absorbing aerosol* problems.